Three Piece Ball Valve

AC-305MF Series
PED Category I, II

AC-305MF User Manual

English Version

Use for company in Europe who will place the product on the market, please amend which necessary.

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Contents

1. General Precautions Page- 2~3

2. Product Description Page- 4

3. Design Specification Page- 5

4. Pressure Temperature Ratings Page- 4

5. Delivery Condition and Storage Page- 6

6. Installation and Operation Page- 6~8

7. Maintenance Page-9~11

8. Torque Data Page-11

9. Corrosion Data Page-11

1. General Precautions

a. Material Selection:

The possibility of material deterioration in service and the need for periodic inspections is depended on the contained fluid. Carbide phase conversion to graphite, oxidation of ferrite materials, decrease in ductility of carbon steels at low temperature (even in applications above -29℃) are among those items. Even information about corrosion data is provided in this user manual, the user is requested to take attention or consideration to determine the suitability of material in their application.

b. Pressure-Temperature rating:

The Pressure-Temperature rating is considered for static pressure. Please refer to P & T rating section on page 9 for working precaution. The allowable temperature is between R.T. and 200℃ do not exceed the temperature range to avoid danger accident happen.

c. Fluid thermal expansion:

It is possible, when the ball valve is in closed condition, the sealed cavity within the valve body to be filled with liquid. If this liquid is not released, by partially opening the valve or some other means, and it is subject to a temperature increase, excessive pressure sufficient to cause pressure boundary failure can be generated. However our products have pressure self-relief seat to prevent pressure built up, user is recommended to prevent that the pressure in the valve will not exceed that allowed pressure, by means of piping design, installation, or operation procedure.

d. Static electric effect:

The ball valves are provided with anti-static devices for ball-stem-body. When service conditions require electrical continuity to prevent static discharge, the user is responsible for specifying static grounding.

e. Fire safe condition:

Generally, the application of the valve shall comply with the Pressure-Temperature rating range. If the risk of fire is major effect, user is recommended to select our fire-safe products, which with API-607 approval. Contact to the valve distributor or manufacturer for details.

f. Liquids with high fluid velocity:

When ball valves must be operated frequently on liquids with very high velocity, a check shall be made with the valve distributor or manufacturer for appropriate advice to minimize the possibility of seat deformation, especially when they are highly pressurized on high-temperature line.

g. Throttling service: Ball valves are generally not recommended for throttling service, where both the fluid flow and the leading edge of the ball can damage or deform the resilient ball seats causing leakage. High fluid velocity or the presence of solid particles in suspension will further reduce seat life in throttling applications.

h. Do not open the bonnet or cap when bearing pressure. Valve is not equipped with pressure access device. User should check it by other method through its piping system.

i. Do not touch the surface of valve on high temperature.

j. Not allowed for unstable fluid, otherwise specified with catogory III in Declaration of conformity or/and in this user manual.

k. Lock design on the handle to avoid the valve operated by non-related people is optional requested by the user.

2. Product Description

2.1 Feature

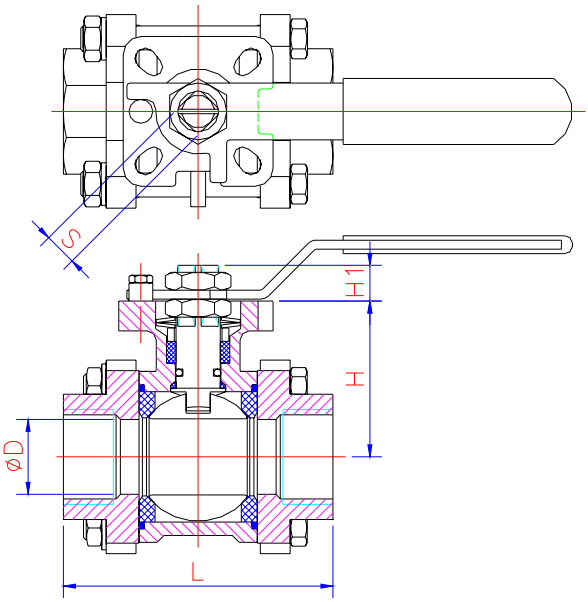
a. 3-PC Full Port 1000 WOG Ball Valve
b. Direct Mounting Of Actuators To Valves, No Need Bracket & Adaptor.
c. Multiple ISO Hole And Well-Machined Mounting Pad in One Valve Simplify Installation of DA & SR Actuator.
d. Three- Piece Swing-Out In-Line Maintenance Design
e. Self-Adjusting Stem Packing Assembly With Belleville Spring For Temperature Fluctuations, Vibration.
f. Bottom Entry Blow-Out Proof Stem Provides Maximum Safety.
g. Heavy-duty body & end cap construction with traceable heat number.
h. Pressure balance hole in ball slot.
i. Pressure self-relief seat to prevent pressure built up.
j. Lock design on the handle is optional requirement.

2.2 Product specification

The scope of product specifications are as following

Item No.	PN	No CE Marking	Category I	Category II
AC-305MF	63	DN 8, 10, 15, 20, 25		DN 32, 40, 50, 65, 80,100

2.3 Common dimension



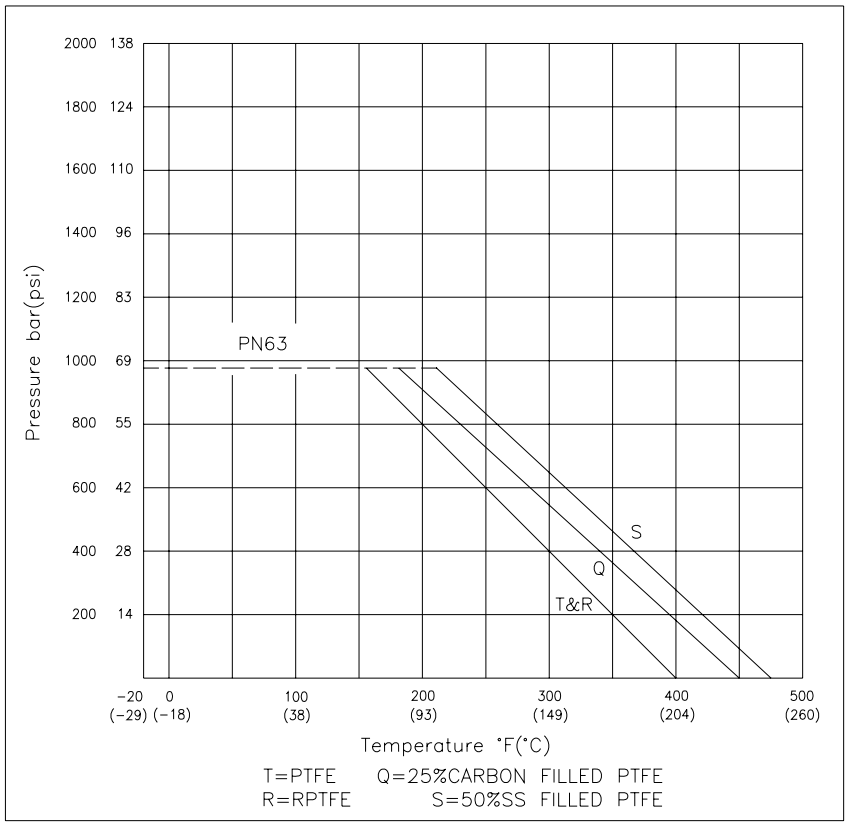
SIZE	ØD	L	ISO-5211	H	H1	S	Torque N-M
1/4"	9	71	F03-F04	43	9	9	4.2
3/8"	12	71	F03-F04	43	9	9	4.2
1/2"	15.0	82	F03-F04	46	9	9	12
3/4"	20.0	73	F03-F04	45.4	9	9	13
1"	25.0	85	F04-F05	55.8	9	9	18
1-1/4"	32.0	96	F04-F05	60.2	11	11	22
1-1/2"	38.0	114	F05-F07	75.5	11	11	42
2"	50.0	134	F05-F07	83.3	14	14	55
2-1/2"	65.0	180	F05-F07	107.9	17	17	78
3"	80.0	200	F05-F07	116.6	17	17	120
4"	100	228	F10-F12	131.7	22	22	150

3. Design Specification

Items	Standards/Codes
Standards of Design (P-T rating)	prEN 12516-1
Testing	prEN 12266-1
Material of Casting (Body, Cap, Ball)	EN 10213-4 for 1.4308 & 1.4408 EN 10213-2 for 1.0619
Bolt and Nut	ASTM A193.A194
Mounting Pad	ISO-5211

4. Pressure Temperature Ratings

The pressure-temperature rating of ball valves are determined, not only by valve shell materials, but also by sealing materials used for ball seats, stem packing, and body seal. Sealing materials may be high molecule, elasticity and hardness, however, the choice is limited by the characteristics of the service fluid, temperature, pressure, velocity of fluid, frequency of valves operation and sizes of ball valves etc, Followings are the general rating charts for non-shock fluid service for floating ball valves distinguished by sizes and seating materials, please refer to section 1, General precaution.



FLOW CHARACTERISTICS

The approximate flow rate through a valve can be calculated as follows:

Where ;

Q = flow rate in gallons (U.S. Std.) per minute

Cv = valve constant

P = pressure drop across the valve in pounds per square inch

G = specific gravity of the media of relative to water

$$Q = Cv\sqrt{\frac{\Delta P}{G}}$$

Note: The values derived from the flow equation are for estimating purposes only. Product variances or systemic factors may alter actual performance.

Valve Size	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
Cv Value	6	7	10	25	35	46	80	110	310	360	820

5. Delivery Condition and Storage

Valves stay in the open condition during the transportation. For incoming QC, it must check:

a. Packing condition: Is there any damaged during the transportation.
b. The bolts of cap and yoke: to make sure the bolt does not loose tightness when it arrived.

Valves must store in an indoor warehouse to avoid dusts and other foreign object, do not exposed in an open space without to put a cover over or take off the packing under an unnecessary situation.

6. Installation and Operation

6.1 Handling

During the ball valve installation, it must follow the procedure to handle at the both side of the bodies. If using cable for big size valve, be make sure the cable must be strong enough to ensure the safety during the installation.

6.2 Cleaning

Even the valves was transported under a clean environment, operator must check is there any foreign body or dusts inside the bore. If yes, clean it before installation. Operator clean the valves by water, compression air, or steam (automation valve shall be cleaned only with water or steam, the compression air is not allowed.) For cleaning operation, first step is put the valve bore perpendicular to the ground and

clean, ensure all the dusts can be removed from the bore. The second step is checking and clean all the connecting pipe bore and connection area. No flush, rust and foreign bodies allow to avoid the blocking and leakage.

6.3 Valve Installation (Install to the pipeline system)

a. Direction

Most of the valves do not restrict the flow direction.

b. Position

The body, cap and gasket are in the connection area of ball valve and pipeline. The bear weight ability and gradient are very important to the pipe installation. Do not make the pressure from the pipeline and stress to concentrate on the connecting area of body and cap. It will cause the deformed and leakage, and the ball, seat, and stem will stick, leaking, and damaged.

c. Fittings

Select the correct specification of pipeline.

Tight the ball valve to the pipeline adequately.

THREADED valves

The following serves as a guideline for those experienced in pipe joint makeup. Otherwise, services of a certified pipe fitter should be utilized for installation.

1. Ensure that both the male pipe and female valve threads are free from dirt, debris and corrosion. Wire brushing of the male pipe threads is recommended to ensure a good metal-to-metal joint.

2. Apply a good quality thread lubricant (pipe dope) on the male threads. Lubricant reduces friction when pulling up the pipe joint. Note, thread lubricant is not intended to seal the joint and will not compensate for poor quality male pipe or fitting threads.

3. Turn the female valve threads onto the male pipe threads by hand. Upon free engagement of the threads, continue to turn the valve as far up as it will go (by hand). With the use of a wrench continue to tighten the valve onto the pipe. The pipe joint seal should occur within 1 to 3 turns. Care should be taken not to exceed 3 turns in which damage to the threads can occur. n IMPORTANT When installing a threaded valve fully assembled, apply the wrench first to the Pipe Connector being engaged by the male pipe thread; fully make up pipe joint. (See Figure 1). Complete

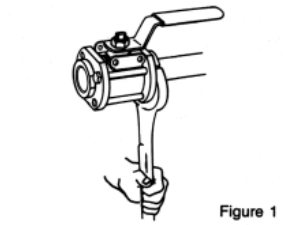


Figure 1

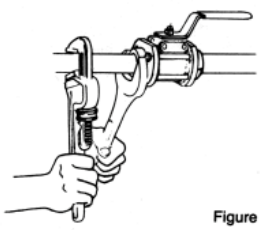


Figure 2

the installation by assembling pipe to the other connector while that connector is securely held against rotation with a second wrench. (Figure 2).

Butt & Socket Weld Valves

To avoid damaging seats and seals by exposure to welding temperature, the Center Section must be removed while the end caps are welded separately into line. Both butt and socket weld valves may be tack welded in place assembled, as long as the Center Section is removed while the welds are completed. (Seal temperature must never exceed 400 °F). Care must be taken when 'cutting' a valve into a line that the gap created to accept the valve is the correct, practically in the case of butt-welded valves.

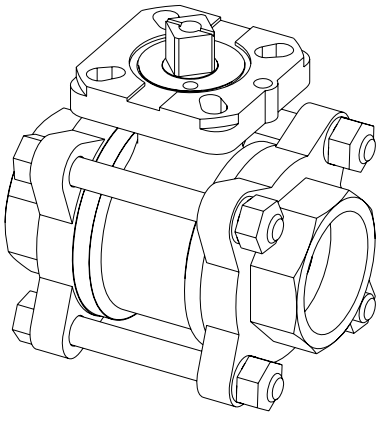
The socket-stop dimension for socket weld valves are listed in the adjacent chart. For socket weld valves it is good practice to provide a gap of approximately 1.6 mm between the end of the pipe and the bottom of the socket, before welding.

d. Systems hydrostatic test

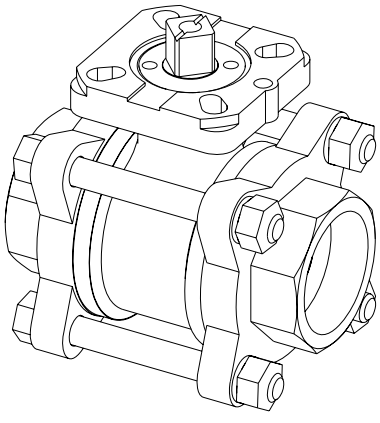
Before delivery, valves are tested 1.5 times the allowable pressure at ambient temperature in open position. After installation, the piping system may subject to system tests, as condition not to exceed the above mentioned pressure.

6.4 Operation

a. For manual operation, shift the handle in counter clockwise direction for close and clockwise for opening.
b. If the handle is in parallel position with the flow direction, the valve is open. If the handle is in right angle position with the flow direction, the valve is close.
c. When installing actuator or the valve is operated with removable handle, the user should ensure the position of the valve whether open or close. There is sign at the top of stem for square type stem. Following with the fig., showing how to access the position of ball valve.



OPEN



CLOSE

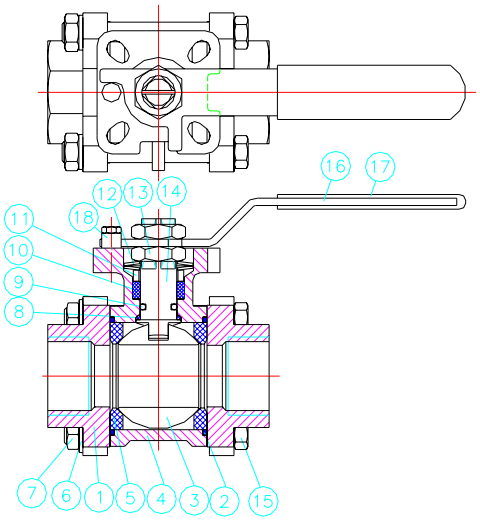
7. Maintenance

7.1 Maintenance frequency

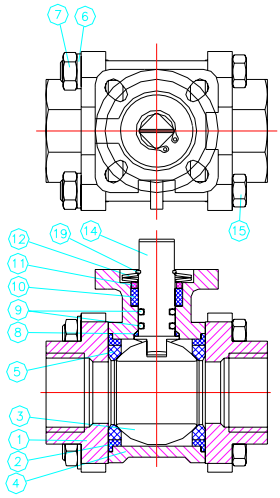
The maintenance frequency is determined upon the application of ball valve. User shall consider the time interval depend on the kinds of fluid, flow velocity, operation frequency, high-pressure effect and high-temperature effect etc.

7.2 Disassembly

a. The user should check the service kit of AC-305MF, if available in the local market, if not, please do not disassembly the valve, otherwise, please make a order from the original manufactory for the service kit.
b. To dismantle the valve must follow the procedure and drawings and be take care as mentioned below.
c. It doesn't matter where is the position of valve located, usually it contained the seal up fluid, so operator must be very carefully when remove the valve on the pipe. It must open the ball a little and let the fluid come out slowly, it also need to watch out the poisonous and inflammability objects if there is any.
d. It must turn the ball in the close position before dismantle the valve. The ball cannot be taken out from valve body if the ball is in the open or semi-open position.
e. To dismantle the valve body, release the end cap carefully. It must be take care to dismantle the ball to avoid the seat retainer fall down from end cap.
f. To lift the ball by hoist, it must make the protection on corner to avoid the ball damaged by metal contacted. The right position for store the valve is put the open end on to the ground. This procedure is protecting the surface of the ball.



Size:3/4"~4"



Size:1/8"~1/2"

NO	PART NAME	MATERIAL
1	CAP	ASTM A351-CF8M
2	BODY SEAT	PTFE
3	BALL	ASTM A351-CF8M
4	BODY	ASTM A351-CF8M
5	BALL SEAT	PTFE
6	WASHER	SS304
7	NUT	SS304
8	STEM SEAL	PTFE
9	O-RING	VITON
10	STEM PACKING	PTFE
11	GLAND	SS304
12	BELLEVILLE WASHER	SS301
13	NUT	SS304
14	STEM	SS316
15	BODY BOLT	SS304
16	HANDLE	SS304
17	GRIP	VINYL
18	STOP PIN	SS304
19	SNAP RING	SS304

7.3 Parts inspection, maintenance and replacement:

a. Check the surface of ball is it scraped? It may use the PT for inspection if necessary. If there is any damaged on the surface, than found out the root cause such as the dirt fluid…etc. It must avoid the damage factors as far as possible.

b. The damaged of the ball surface, to gauge is it located on the contacting area of ball and ball seat? If it is the case, than the ball must take a fine milling. If it cause a heavy damaged, than it must welded and re-machined again. If it cannot be repaired than change a new ball.

c. If the scraped area is not at the location described in the item b above, than it must re-fine milling the damage area again. Otherwise, the ball will damage the soft seat during the open and close operation or it will dig out the ball seat and cause a heavy damage to ball and seat.

d. Check the wall thickness of valve body and cap. The minimum thickness shall be maintained in according to EN12516-1 table 10.

e. To inspect the surface of soft seat, has it any scrape mark, concave, dusts (including weld dregs, iron bit, sands…etc.), abrasion, abnormal press scrape, and a tiny scrape. Usually, the scrape mark and damage by dusts will occur the same time as ball damaged. It is the root cause for leakage. If leakage occur before repairing, than suggest to change a new soft seat (PTFE or RTFE). The mark from press or fine scrape is happen in an abnormal operation pressure. It

must reconsider to choice a right valve.

f. The stem packing may be replaced by the new parts after dismantle the valve. User shall make sure that the your distributor able to serve the same packing of your valve if you do not have a service pack. To tight the gland nut, please see Section 8 for torque data.

g. To do the final inspection for a valve, it must operate 10 times of open and close to ensure all the parts are assemble correctly. To ensure the torque in a same value during the open/close operation. If the torque is not the same in operation, than it may has some parts in a not corrected position or interference. It must dismantle and re-assembly. Otherwise, it is easy to damage if let this valve works on a pipeline under higher pressure.

7.4 Assembly

For assembly process, it takes the opposite way of dismantle process. The valve must in the close position during assembling the body and end cap, the stopper must be located at the right place, otherwise, the open and close operation will be opposite. When tightening the bolts, it is important to tight them in a cross serial order to prevent a unbalance fitting.

8. Torque Data

Size	DN8	DN10	DN15	DN20	DN25	DN 32	DN 40	DN 50	DN 65	DN 80	DN100
Stem Nut N-M	12	12	12	12	17	17	24	24	35	35	40
Body Bolt N-M	8	8	8	17.5	17.5	34	34	59	113	113	113

9. Corrosion Data

The following corrosion data is just for information only.

AIR TORQUE S.P.A.
Head office and works:
AIR TORQUE S.P.A.
Via Palazzo 24061 Albano S.A. (Bg) Italy www.airtorque.it

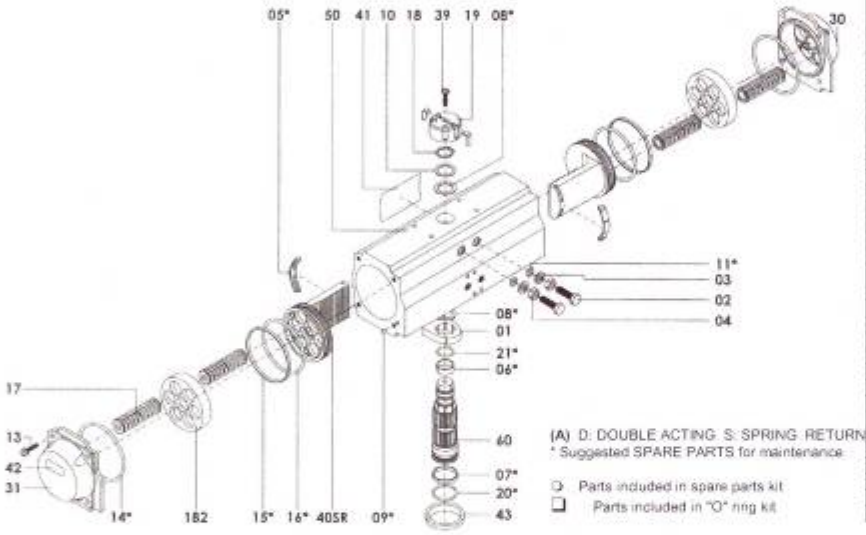
MAINTENANCE INSTRUCTIONS FOR 4TH GENERATION ACTUATORS 180° ROTATION DOUBLE ACTING MODELS AT058 D - AT608 D AND SPRING RETURN MODELS AT058 S – AT308 S (SEE ALSO INSTRUCTION MANUAL FOR STANDARD ACTUATORS IMAT 4thG01/99)

The information given in these maintenance instructions is the information necessary to make the maintenance of 4th generation actuators 180° rotation double acting and spring return and the replacement of the spare parts as per standard 90° rotation actuators.
Important: as concerns other information like warning, working conditions, operating function and direction of rotation, actuator installation instruction, tightening torque for screw and storage instruction see the instruction manual IMAT 4thG01/99.

1) MAINTENANCE INSTRUCTION

With the information given below, AIR TORQUE provides the end user with all the required information necessary for maintenance. Under normal operating conditions the actuator requires only periodic observation to ensure proper adjustment.
Rebuilding of the AIR TORQUE actuators is allowed only to the personnel of AIR TORQUE or to personnel which are properly instructed. By contravention the guarantee expires!
Spare kits for maintenance are available to replace all seals and bearings (Soft components listed in table) that may be necessary between 300,000 and 1,000,000 cycles depending on operating and/or environmental conditions and actuators size.

1.1) DRAWING WITH ITEMISED COMPONENT AND RECOMMENDED SPARE PARTS, figure A

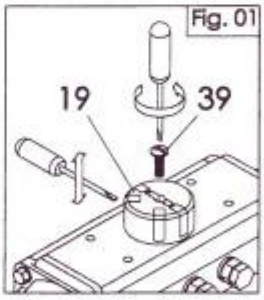


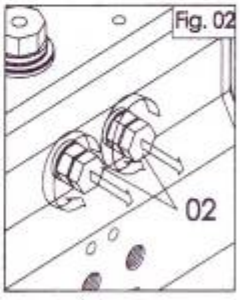
(A) D: DOUBLE ACTING S: SPRING RETURN
* Suggested SPARE PARTS for maintenance
❍ Parts included in spare parts kit
❑ Parts included in "O" ring kit

PART N°	Spare Parts	UNIT Q.TY (n) D	S	PART DESCRIPTION
01		1	1	OCTI-CAM (180° Stop arrangement)
02		2	2	STOP CAP SCREW
03		2	2	WASHER
04		2	2	NUT (Stop screw)
05*	❍	2	2	BEARING (Piston back)
06*	❍	1	1	BEARING (Pinion top)
07*	❍	1	1	BEARING (Pinion bottom)
08*	❍	2	2	THRUST BEARING (Pinion)
09*	❍ ❑	2	2	PLUG
10		1	1	THRUST WASHER (Pinion)
11*	❍ ❑	2	2	"O" RING (Stop screw)
13		8	8	CAP SCREW
14*	❍ ❑	2	2	"O" RING (End cap)
15*	❍	2	2	BEARING (Piston head)
16*	❍ ❑	2	2	"O" RING (Piston)
17		NA	min. 10 max.24	SPRING (Cartridge)
18		1	1	SPRING CLIP (Pinion)
19		1	1	POSITION INDICATOR
20*	❍ ❑	1	1	"O" RING (Pinion bottom)
21*	❍ ❑	1	1	"O" RING (Pinion top)
30		1	1	RIGHT SX END CAP
31		1	1	LEFT SX END CAP
39		1	1	CAP SCREW (Indicator)
40SR		2	2	PISTON
41		1	1	ACTUATOR IDENTIFICATION LABEL
42		2	2	END CAP LABEL
43		1	1	SPIGOT (Only on request)
50		1	1	BODY
60		1	1	DRIVE SHAFT
182		NA	2	SPRING DISK

1.2) DISASSEMBLY

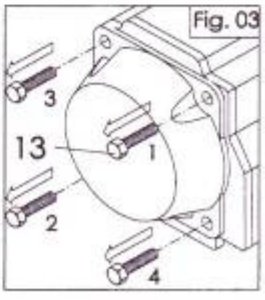
When disassembly of actuator is required for maintenance, firstly remove the actuator from the valve. Before performing any disassembly operations it is important to verify that the actuator is not pressurised. Always use caution and double check that the ports 2 and 4 are vented and are free from any accessory and/or device. When the actuator is a spring return unit, make sure that the actuator is in the failed position before disassembling.





A) Removal of position indicator (Part No. 19), figure 01:
- ❑ Remove cap screw (39) if fitted
- ❑ Lift position indicator (19) off shaft, it may be necessary to pry gently with a screwdriver.

B) Removal of stop cap screws (Part No. 02), figure 02:
- ❑ Remove both stop cap screws together with nut (04) and washer (03)
- ❑ Remove stop screw O-rings (11) and discard if replacing all soft parts.



C) End Caps disassembly (Part No. 30 right and 31 left), figure 03:
Before proceeding to the end caps disassembly put the actuator in vertical position and proceed as below described first on one side and then on the other side of the actuator.
- ❑ Remove cap screw (End cap 13) in the sequence shown in the figure 03. Caution: when disassembling a spring return actuator, the end cap (30 and 31) should be loose after unscrewing end cap bolts (13) 4-5 turns. If there is still force on the end cap after 4-5 turns of the end cap bolts, this may indicate a damaged spring cartridge and any further disassembly should be discontinued. Further disassembly of the end caps may result in injury. Return actuator to AIR TORQUE for further maintenance.
- ❑ For spring return actuators remove the external spring set (17), then remove the spring disk (182), then remove the internal spring set, figure A.
- ❑ Remove end cap O-rings (14) and discard if replacing all soft components.

D) Pistons disassembly (Part No. 40SR), figure 04:

- ❑ Holding the body (50) in a vice or similar device, rotate the drive shaft (60) until the pistons (40) are released.

Caution: Air pressure should not be used to remove the pistons from the body.

- ❑ Remove piston 'O' rings (16) using a small screwdriver; remove the piston back (05) and piston head (15) bearings. Discard o-rings and bearings when replacing all soft components.

E) Pinion shaft disassembling (Part No 60), figure 05:

- ❑ Remove spring clip (18) carefully, using nap-ring pliers, remove external thrust bearing (08) and thrust washer (10).
- ❑ Apply downward force to top of drive shaft (60) until it is partially out of the bottom of the body when it is possible to remove the octi-cam (01) and internal thrust bearing (08), then push the pinion (60) completely out of the bottom of the body. If pinion does not remove freely gently tap the top of the shaft with a plastic mallet.
- ❑ Remove top and bottom pinion bearings (06)and (07) and top and bottom pinion O-rings (21) and (22).
- ❑ Discard bearings (06) and (07), internal and external thrust washer (08) and O-rings (21) and (22) if replacing all soft components.

When all components are disassembled, those not being replaced should be properly cleaned and inspected for wear prior to being greased and re-assembled.

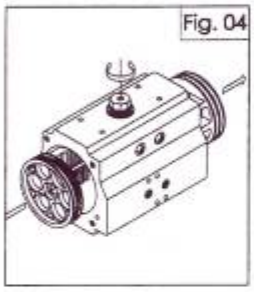


Fig. 04

Fig. 05

Fig. 06

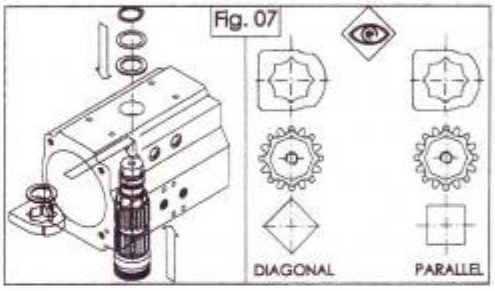


Fig. 07

1.3) ASSEMBLY :

Prior to assembly, ensure all components are perfectly clean and free from damage. Please see standard instruction manual N° IMAT 4thG01/99 at point 3 for recommended lubricants.

A) Drive shaft assembly (Part No. 60), figures 06 and 07:

- ❑ Install top and bottom pinion bearings (06) and (07) and top and bottom pinion O-rings (21) and (22) onto the shaft.
- ❑ Grease the outside surface of the drive shaft on top and bottom as shown in figure 06.
- ❑ Insert partially the drive shaft (60) in the body (50), install octi–cam (01) in the correct position as shown in figure 07 related to the bottom and top of the drive shaft and the rotation of the actuator when energised and install internal thrust bearing (08). Insert completely the drive shaft in the body.
- ❑ Fit external thrust bearing (08), thrust washer (10) and then external circlip (18) using snap ring pliers.

B) Pistons assembly (Part No. 40SR), figures 08, 09, 10 and 11:

- ❑ Install piston O-rings (16), the Piston skirt (05) and piston head (15) bearings.
- ❑ Grease the internal surface of the body (50) and the piston (40SR) rack teeth.
- ❑ Hold the body (50) in a horizontal position by inserting the top of the shaft into a vice or the bottom of the shaft connection into a male drive fitted in a vice as shown in figure 08.
- ❑ Ensure that the octi-cam is in the right position as shown in figure 09.
- ❑ For standard rotation assembly (clockwise to close) rotate the body (50) about 40-45° counter-clockwise from bottom view or clockwise from top view depending on which way the shaft has been linked as shown in figure 10.
- ❑ Press the two pistons (40SR) simultaneously inside the body (50) until the pistons are engaged and rotate the body clockwise from bottom view or counter clockwise from top view until the stroke is completed.
- ❑ Ensure that when the pistons are inserted they both mesh at the same time. Check fully closed and open positions as shown in figure 11.

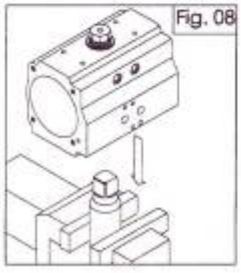


Fig. 08

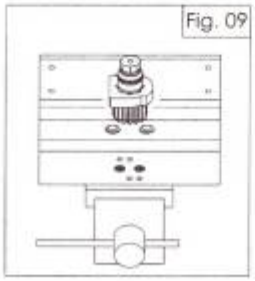


Fig. 09

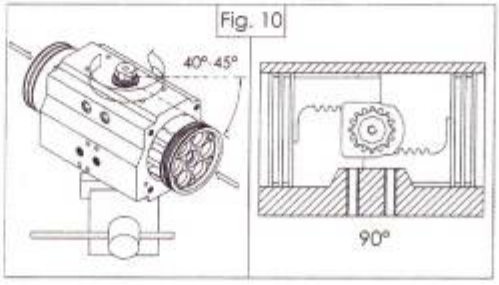


Fig. 10

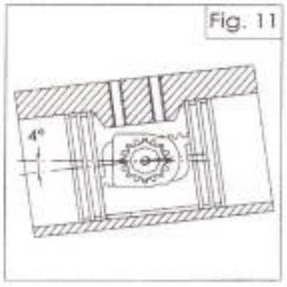


Fig. 11

C) Spring set assembly (Only for Spring Return Actuators)
Before proceeding to the end caps assembly put the actuator in vertical position and proceed as below described first on one side and then on the other side of the actuator.

- ❑ Insert the proper quantity of spring cartridges of the internal spring set according to the pattern shown in figure 12 (referring to the total number of springs). Individual springs should be inserted as shown in figure 13.
- ❑ Insert spring disk (182) on the springs making sure of the correct orientation, figure A.
- ❑ Insert the proper quantity of spring cartridges of the external spring set according to the pattern shown in figure 12 (referring to the total number of springs). Individual springs should be inserted as shown in figure 13.
- ❑ Then proceed in the same way for the other side.

D) End cap (part 30 right and 31 left) assembly, figure 14:

- ❑ Fit end cap O-ring seal (14) into the groove in the end cap, on both end caps.
- ❑ Fit end caps onto the body (50), verifying that the O-ring remains in the groove.
- ❑ Insert all the cap screws (13) and tighten each only partially. Complete tightening by following the sequence indicated in figure 14.

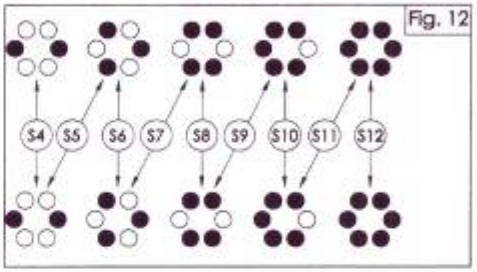


Fig. 12

E) Assembly of stop cap screws (Part 02), and stroke adjustment figure 15:

- ❑ Insert on both the stop cap screw (02), the nut (04), the washer (03), and the O-ring (11)
- ❑ Fit the stop cap screw (02) in the body.

Stroke adjustment for standard rotation actuator (Clockwise to close):

- ❑ 0° (Close) position stroke adjustment with actuator in close position, screw or unscrew the right (from top view) stop cap screw (02) until the desired stop position is achieved. Then tighten the stop adjustment nut (04) to lock it in place
- ❑ 180° (open) position stroke adjustment with actuator in open position, screw or unscrew the left (from top view) stop cap screw (02) until the desired stop position is achieved, then tighten the stop adjustment nut (04) and lock it in place.

F) Assembly of position indicator (Parts No. 19 and 39), figure 16:

- ❑ Fit position indicator (19) on the shaft verifying that it indicates the correct actuator position.
- ❑ Then fit cap screw (39) where fitted.

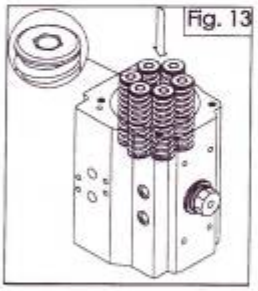


Fig. 13

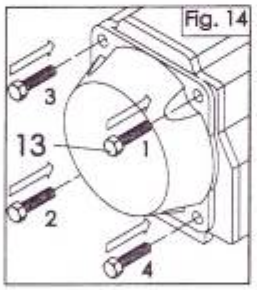


Fig. 14

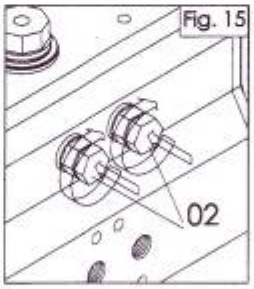


Fig. 15

Fig. 16

Tool Size for Maintenance

Model	EX1 mm	EX2 mm	Ø d mm
AT 058	10	8	14
AT 108	10	10	16
AT 208	13	10	22
AT 258	13	10	25
AT 308	17	13	26
AT 358	19	13	36
AT 408	19	17	38
AT 508	22	19	48
AT 608	30	22	58